(54) Title: METHOD AND SYSTEM FOR PERSONALIZING IMAGES INSERTED INTO A VIDEO STREAM
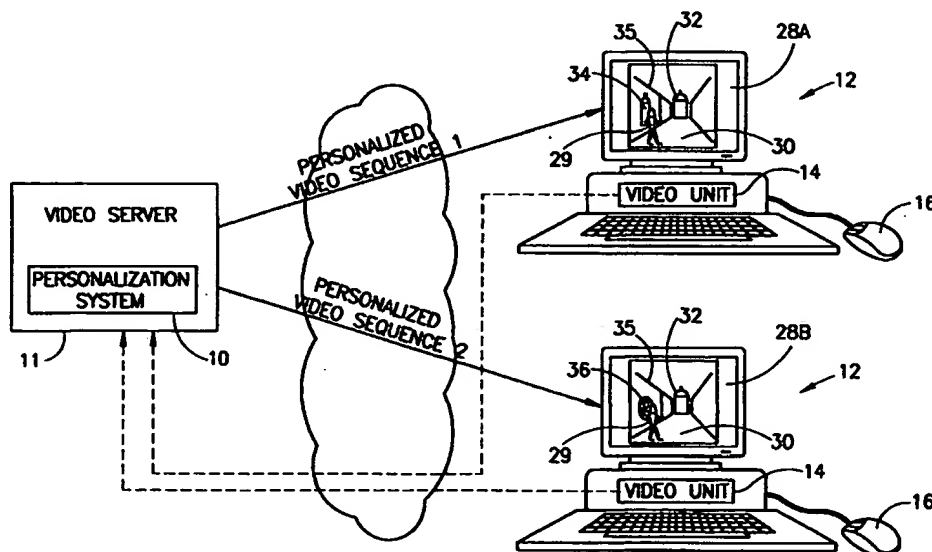
(57) Abstract

   A method and system for personalizing images inserted into a video stream, provided by a video service (11) to each of its clients (12) according to a priori individual knowledge of its clients. The present invention generates a user profile (10) from video sequences selected by the user from a video server (11) having a plurality of video sequences stored therein. The selected video sequence is personalized according to the user profile, for transmission to the user (12).

METHOD AND SYSTEM FOR PERSONALIZING IMAGES INSERTED INTO A VIDEO STREAM

FIELD OF THE INVENTION

5   The present invention relates to systems and methods for inserting images into a video stream in general.

BACKGROUND OF THE INVENTION

Currently, video services mainly include broadcasting of standard TV programs over the air, through cable systems or via satellite. The latter is in the

10   form of digital video. Other digital video services are mainly transmitted point-to-point via communication networks such as the telephone system or the Internet.

There are two forms of TV advertising. In one, an advertising video clip is shown between portions of a TV show or static images are superimposed on a

15   portion of a screen. In another, bulletin boards of advertisements are seen. The latter is common at sports events where the advertising boards ring the sports arena and are seen both by the spectators at the event and by the viewers seeing the event via TV.

Because the sports events occur in one location, the advertising boards

20   generally have advertisements thereon of the companies which market in that location. However, if the sports event is broadcast by TV, it can be viewed by

many other viewers, few of whom are in the locale of the sports event. As a result, the advertisement may be ignored by the viewers.

There exist systems which can insert images into the video stream to replace the advertisement on the advertising board. These systems use the

5   chroma-key method to replace the portions of each frame of a video stream having a specific color or colors.

One system, described in U.S. Patent 5,491,517 and owned by the common assignees of the present invention, inserts images onto specific portions of the playing field. The disclosure of U.S. Patent 5,491,517 is incorporated

10   herein by reference.

The insertion of the images is typically performed at the local broadcasting station and, typically, the images to be inserted are advertisements for local products.

At present, digital video services exist mainly in the form of TV using

15   direct broadcast from satellite (DBS), such as: directTV in the US, or over the Internet as a downloadable file or as a live stream (using products from Real Networks of the USA or VDOnet of the USA). The video stream is mainly uni-directional, from the server machine to the client machine. However, in some cases, especially for videos downloaded from the Internet, the client has some

20   control over the playback. For example, the MediaPlayer of the WINDOWS operating system from Microsoft Corporation of the USA, which can be used for playing video streams, has pause/stop, rewind and play controls.

2

Advertising on the Internet is limited to messages displayed in fixed areas of the page or text. The advertisement is typically in the form of a banner with a fixed message or some sort of animation within the banner is also common.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a method and system which enables a video service provider to personalize the video stream provided

5   to each of its clients according to a *priori* individual knowledge of its clients.

The present invention generates an user profile from video sequences selected by the user from a video server having a plurality of video sequences stored therein. The selected video sequence is personalized according to the user profile, for transmission to the user.

10   In another embodiment, the video server broadcasts the video sequence, accompanied by video parameters for placement of insertable images, to a plurality of users, wherein each user has a matched image storage unit, from which at least one image can be inserted into the video sequence transmitted by the broadcaster.

15   In accordance with another preferred embodiment of the present invention, the system and method also include an image server for generating user profiles and for providing images to each image storage unit based on the user profile.

Additionally, in accordance with a preferred embodiment of the present

20   invention, the personalization includes associating group profiles with images to be implanted, selecting at least one image from among the images to be implanted according to the group profile which most closely matches the user profile and implanting the selected at least one image into the video sequence.

4

Moreover, in accordance with a preferred embodiment of the present invention, all of the personalization can occur in a single processing. Alternatively, the implanting can occur in one processing unit and the association and selection can occur in a second processing unit.

5   Finally, the present invention can include receiving user feedback in response to the at least one selected and implanted image and providing the user feedback to the video server.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from

the following detailed description taken in conjunction with the appended drawings

5   in which:

Fig. 1 is a schematic illustration of system for personalizing a video

sequence, constructed and operative in accordance with a preferred embodiment

of the present invention, in conjunction with user computers which receive the

personalized video sequence;

10   Fig. 2 is a block diagram illustration of a personalization system forming

part of the system of Fig. 1;

Fig. 3A is a schematic illustration of transformations, useful in

understanding the operation of the personalization system of Fig. 2;

Fig. 3B is a schematic illustration of a permission mask, useful in

15   understanding the operation of the personalization system of Fig. 2;

Fig. 4 is a block diagram illustration of a personalization module forming

part of the personalization system of Fig. 2;

Figs. 5A and 5B are schematic illustration of mixing operations, useful in

understanding the operation of the personalization module of Fig. 4; and

20   Figs. 6 and 7 are schematic illustrations of two alternative systems for

personalizing a video sequence in conjunction with user computers which receive

the personalized video sequence.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

The present invention is a system for personalizing video based on some knowledge (e.g. sex, age, hobbies, etc.) of the individual user requesting the video. The personalization can take many forms. It can be an advertisement for

5   a company present only in the area where the user lives or works or for a company selling products of a type the user is known to like or for any other type of product or service which relates to the individual knowledge of the user. There can be multiple advertisements. For systems where the user can provide input, the personalization can change over time in response to some or all of the user's

10   input.

Reference is now made to Fig. 1 which generally illustrates the operation of the system of the present invention.

The personalization system 10 operates on a video server 11 and communicates with a multiplicity of user computers or "clients" 12 (two are

15   shown), typically via a network of some kind, such as a local area network and/or the Internet. The network communication is typically bi-directional, as described hereinbelow. The bi-directional communication can also be formed from a broadcast download to the user computers 12 and communication from the user computers 12 via the telephone system or the Internet.

20   Each user requests whichever video sequence he desires to see. The requested video sequence is personalized with advertising images whose predefined profile the user fits. For example, company A might want to advertise to young men who like to read science fiction books. If the user fits this description, his video sequence will include the advertising image or images of

company A. Company B might want to advertise to children who recently took an algebra course.   The video sequence requested by such a child will have company B's images implanted therein.

5   For example and as shown on the monitors 28 of computers 12, the video might include the movement of a person 29 along a street 30 to a building 32. For a first user who is known to be a young person, the advertisement might be for a drink. Fig. 1 shows a drink bottle 34 on one wall 35 of a building along the street, in the monitor labeled 28A. For a user who is known to be a soccer fan, the advertisement might be for a sports company. Monitor 28B shows a soccer

10   ball 36 on wall 35.

        In this example, both users view the same video but each receives a different advertisement, personalized by their user profile. It will be appreciated that the two users can view different video sequences but the implanted images that they will receive are a function of their profile.

15   In order to display the personalized video, the user computer 12 typically includes a video unit 14.   Such a unit is similar to the REALVIDEO video application manufactured by Real Networks with which a user communicates with a video server and which receives and displays a video stream.

        Each user's profile is typically created and updated based on his or her

20   input. The input can be in answer to a questionnaire, it can be gathered from the user's responses to the advertising images previously implanted in his personalized video sequence, it can be based on the user's address on the network or any other fact about the user which the server 11 has the ability to gather.

8

The user computer 12 also includes a pointing device 16, such as a mouse, a trackball, a touch screen, etc. with which the user can point to objects on the screen. The operating system of the user computer 12 monitors the cursor movements and selections of the user and provides the location to which the user

5   pointed to all of the applications on the computer, including the video unit 14.

Video unit 14 compares the location received from the operating system with the area or specific pixel locations of the implanted image, as provided from the video server 11. The data from the server 11 is described in more detail hereinbelow.

10   If the user, once he views the personalized video, indicates the implanted image using pointing device 16, video unit 14 can transmit an indication of this fact, including the name associated with the object, to the video server 11. The video server 11 typically responds to the user's request and the user identifier 20 (Fig. 2) uses this information to update the user's profile.

15   The video server 11 can also gather information regarding the responses of its users to the various advertising images which the personalization system 10 implants. This information is valuable feedback to the companies about the quality of their advertisements and/or products.

Reference is now made to Fig. 2 which illustrates the system of the

20   present invention, to Fig. 4 which details elements of the system of Fig. 2 and to Figs. 3A, 3B and 5 which are useful in understanding the operation of the system of Fig. 2.

The personalization system 10 comprises a user identifier 20, a user database 21, an object storage unit 22, a video controller 24, a video analyzer 25

and a plurality of video personalization modules 26, one per user currently
receiving a video stream.

The user identifier 20 operates to identify the client or some aspect of the
client.   The user identifier 20 acquires the identifying information once the
5   communication between the user and the server has been initiated. Typically,
when the user accesses the video server, there is either some login procedure, as
is common for video servers on the Internet which charge money for their
services, or some handshaking between the client computer and the server which
results in the server uniquely identifying the client computer. The login procedure
10   can include questions which the user must answer from which the user identifier
20 builds a profile of the user or it can simply ask the identification of the user.
The former is common as part of setting up a subscription with the video server.
The latter is common once the user is a subscriber to the service.

After logging in, the user identifier 20 then provides the user's profile to
15   the object storage unit 22 which, in turn, compares the user's profile to a set of
profiles predefined by the advertisers for each of their advertising images or sets
of images. The object storage unit 22 selects the closest stored profile. The
profiles typically group users by any desired characteristic, or set of
characteristics, of the user, such as residential area, family data, hobbies, sex,
20   etc. or based on the user's previous requests.

Fig. 2 shows the same example display as Fig. 1, where a young user
receives a drink advertisement and a soccer fan receives a soccer advertisement.

Another method for identifying the user utilizes the handshaking
information, which uniquely identifies the computer 12 to the server. For example,

when a computer 12 accesses the video server via the Internet, the computer 12 has to indicate the Internet Protocol (IP) address at which computer 12 is connected to the Internet. These IP addresses are regionally allocated and thus, user identifier 20 can determine the approximate geographic location of the computer 12 and can use this geographic location as the user profile.

The user identifier 20 provides the object storage unit 22 with the user profile and provides the user's video request to the video controller 24.

The object storage unit 22 stores the various images to be inserted into the videos and organizes them according to the group profile defined for them. The personalized data can be a single image to be inserted multiple times and/or a set of images to be inserted within the video at different times. The personalized data includes a name for each image to be inserted as well as a schedule of when and for how long to implant each image.

In response to a received user profile, object storage unit 22 determines the group profile which most closely matches the user profile and outputs the images associated with the matched group profile. If there are more than one set of images associated with the matched group profile, the object storage unit 22 selects one of the sets of images. Furthermore, object storage unit 22 can update the user profile to mark which set of images the user has already been seen.

Video controller 24 selects a video sequence for each user in response to his request. The video sequence can either be a stored or a real-time one. The video controller 24 also receives video parameters from video analyzer 25 defining how to implant the images. As described hereinbelow, the video analyzer 25 generates the parameters from analyzing each frame of the video sequence.

This analysis is performed in real-time, if the sequence is received in real-time, otherwise, it is performed off-line.

Object storage unit 22 and video controller 24 both provide their output to the personalization module 26 associated with the user. Object storage unit 22
5   outputs the personalized data, such as a set of advertisements, associated with the user's group and the names associated with each image to be implanted and video controller 24 provides the selected video and the associated video parameters describing how to transform the personalized data in order to implant the personalized data into the video stream.

10 Thus, as shown in Fig. 2, each personalization module 26 receives a user's requested video, the personalized data to be implanted therein and the video parameters. Fig. 2 also shows the output of the two modules 26, assuming that both users requested the same video having the street scene. One user has the bottle 34 implanted therein and the other has the soccer ball 36 implanted
15 therein.

The images of the personalized data are designed "flat", with no perspective in them. One such image 37 is shown in Fig. 3A. However, the surfaces on which they are to be implanted, such as a surface 38, are viewed in perspective.

20 The video analyzer 25 analyzes each frame of the video stream to determine the viewing angle of the camera towards the surface on which the image is to be implanted and which elements of the frame are foreground and which are background. The analysis can be performed in many ways, some of which are described in US 5,491,517 and in PCT Publications WO 97/12480,

assigned to the common assignee of the present invention, the teachings of which are incorporated herein by reference.

According to U.S. Patent 5,491,517, video analyzer 25 has a flat model 37 of the surface. Analyzer 25 finds the surface within each frame of the video stream and determines a transformation T, per frame, from the flat model 37 to the perspective view 38 in each frame. There can be many surfaces which can receive an implant and each implant is associated with only one surface. Fig. 3A shows two surfaces, two implants 39 to be implanted thereon and the resultant perspective implanted images 41.

Video analyzer 25 also determines which elements of the frame are foreground elements and which are background elements. For example, in Fig. 2, the person 29 is a foreground element and the walls 35 and building 32 are background elements. Typically, the background / foreground information is described by a "permission mask" which marks the pixel frame over which the frame the image can be implanted, where implantation is only allowed in the background areas. Fig. 3B illustrates a permission mask 43 for the video frame shown in Fig. 2, where the hatching marks areas where implantation is allowed. The permission mask 43 indicates that the area of person 29 (Fig. 2) is the only area where implantation is not allowed.

The transformations T, location information regarding the location of the surface within each frame, and permission mask form the video parameters which analyzer 25 produces.

The personalization modules 26 use each transformation T to transform, per frame, the flat images 39 of the personalized data into perspective images 41

whose perspective matches that of the surface on which the images are to be implanted. The personalization modules 26 then implant the perspective images 41 into the background of the current frame, thereby producing a personalized frame which is transmitted to the user's computer 12. Typically, the

5   personalization modules 26 also attach data about the area or pixels of the frame where the implanted perspective image is to be found and a name for the implanted perspective image.

Fig. 4 details one video personalization module 26. It comprises a personalized data storage unit 38, an image adapter 40, a video personalization

10   scheduler 42 and a mixer 44.

The personalized data storage unit 38 receives the personalized data for the personalization module 26 and provides a selected image from the personalized data when indicated to do so by the scheduler 42.

The scheduler 42 receives a predefined schedule, which is associated

15   with the personalized data, of when and where to insert an image of the personalized data and for how long. The schedule is prepared in advance, typically according to advertising considerations. Some advertisers will pay for many minutes of insertion while others will pay for minimal amounts. The schedule defines when, and for how long, each image will be displayed. The

20   scheduler 42 also indicates onto which section of the surface the personalized data is to be implanted.

During operation, the scheduler 42 receives a timing signal by which it measures the passage of time, starting from the moment the personalization module 26 first receives the video stream. When so indicated by the schedule,

the scheduler 42 provides an image selection signal to the storage unit 38 which

furnishes the selected image to the image adapter 40. At the same time, the

scheduler 42 provides a location signal to the image adapter 40 to indicate onto

which section of the surface, if there are more than one, to implant the selected

5   image.

Image adapter 40 also receives the transformation and location

parameters from the video controller 24 (Fig. 2). Using these parameters, image

adapter 40 transforms the flat selected image into one with the perspective of the

current frame, as discussed hereinabove with respect to Fig. 3A. Since the image

10   is typically much smaller than a frame, image adapter 40 places the perspective

image in the proper location within a blank frame. Figs. 5A and 5B show two

adapted images 49A and 49B, with the two perspective images of Fig. 3A in their

respective locations within the frame. The hatched portions 50 of Figs. 5A and 5B

remain blank; only the image portions 52 of Figs. 5A and 5B contain image data.

15   Image adapter 40 can be any suitable image adapter which can perform

the adaptation described hereinabove. Two such image adapters are described

in U.S. 5,491,517 and WO 97/12480. The two applications also describe suitable

mixers 44.

Image adapter 40 also defines the space within which the adapted image

20   is placed. This typically is a bounding box around the adapted selected image

which describes where, in the frame, the adapted image is placed.

Mixer 44 mixes the adapted image produced by frame adapter 40 with the

current frame of the video stream to create one frame ("a personalized frame") of

a personalized video stream. Mixer 44 typically uses the permission mask 43

(Fig. 3B) and the adapted images 49A and 49B (Figs. 5A and 5B) to control the mixing process. Wherever the permission mask 43 indicates the presence of the background, implantation can occur.

For implantation, the mixer 44 provides the personalized frame with data
5   of the original frame only if the adapted images 49A and 49B is blank for that pixel. Wherever the adapted images 49A and 49B has image data and the permission mask 43 allows implantation, mixer 44 mixes the image data with the data of the original frame. Mixer 44 can just replace the original frame data with the image data or it can blend the two, or it can perform any desired other mixing
10 operation.

Mixer 44 also transmits the name associated with the implanted image and some indication of its location in the frame. The indication is typically based on the bounding box of the adapted image, as determined by the image adapter 40. However, mixer 44 determines if there are any foreground elements which
15 are superimposed over the implanted image and how this affects the shape of the implanted image.

The indication produced by the mixer is an outline of the area within which the implanted image sits or a listing of the pixels which include the implanted image. This information is transmitted together with the personalized frame. The
20 indication can be used by the video unit 14 (Fig. 1) to determine whether or not the user has indicated the implanted image with his pointing device 16.

It will be appreciated that the present invention provides personalized video streams based on a priori information about a user. Shown here is a

16

system with a video server, with a plurality of personalization modules, connected to a plurality of clients via a data network.

However, other combinations of servers, personalization modules and clients are also incorporated within the scope of the present invention. For
5   example, as shown in Fig. 6 to which reference is now briefly made, the personalization module can reside on the client side of the network. The video server 11 has a personalization preparation system 60 which is similar to the personalization system 10 but it does not include any personalization modules 26. The latter reside in each of the user computers 12 and are referenced 62.

10   In this embodiment, the video server 11 transmits the requested video sequences along with the video parameters and the personalized data to the user computer 12. The individual personalization modules 62 create the personalized videos therefrom, typically "on-the-fly".

Alternatively, as shown in Fig. 7 to which reference is now briefly made,
15   the video sequences can be broadcast, or multi-cast, irrespective of the users requests. In this embodiment, the video server 11 has the personalization preparation system 60 but only transmits one video sequence and its video parameters at a time to the network. Each user computer has a video personalization module 62, as in the previous embodiment; however, in this
20   embodiment, the modules 62 store the personalized data for a significant period of time (in the personalized data storage unit 38 of Fig. 4). Periodically, the personalized data is updated, as indicated by the dashed lines of Fig. 7.

The personalization is, once again, according to the individual preferences of the users. These preferences can be provided to the

17

personalization preparation system 60 via any of the methods described hereinabove.

The personalization modules 62 can reside in the user computers 12 or, if the network is that of cable or satellite television, in a local "set-top" box which
5   provides output to a user television.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described herein above. Rather the scope of the invention is defined by the claims that follow:

CLAIMS

1. A video personalization system comprising:

a video server having a plurality of video sequences stored therein;

means for receiving a selection of a video sequence from a user;

5   means for generating a user profile from user information provided to said video server;

a personalization system for personalizing said selected video sequence according to said user profile thereby creating a personalized, selected video sequence for transmission to said user.

10   2. A system according to claim 1 and wherein said personalization system includes:

means for associating group profiles with images to be implanted;

means for selecting at least one image from among said images to be implanted according to the group profile which most closely matches
15   said user profile; and

means for implanting said selected at least one image into said video sequence.

3. A system according to claim 2 and wherein said means for implanting are implemented in one processing unit and said means
20   for associating and said means for selecting are implemented in a second processing unit.

4. A system according to claim 1 and also comprising means for
receiving user feedback in response to said at least one selected
and implanted image and for providing said user feedback to said
video server.

5   5. A video personalization system comprising:

a video server having a multiplicity of video sequences stored
therein;

a broadcaster for broadcasting a video sequence to a plurality of
clients, wherein each video sequence is accompanied by video
10 parameters for placement of insertable images;

per client:

a local image storage unit for storing a plurality of user-matched,
locally stored images; and

insertion means for inserting at least one of said locally stored
15 images into a video sequence transmitted by said broadcaster.

6. A system according to claim 5 and also comprising an image server
for generating user profiles and for providing images to each local
image storage unit based on the user profile of the user associated
with each client.

20 7. A method for personalizing video sequences, the method comprising
the steps of:

having a plurality of video sequences stored in a video server;

20

receiving a selection of a video sequence from a user;

generating a user profile from user information provided to said video server;

personalizing said selected video sequence according to said user
5   profile thereby creating a personalized, selected video sequence for transmission to said user.

8. A method according to claim 7 and wherein said step of personalizing includes the steps of:

associating group profiles with images to be implanted;

10   selecting at least one image from among said images to be implanted according to the group profile which most closely matches said user profile; and

implanting said selected at least one image into said video sequence.

15   9. A method according to claim 8 and wherein said step of implanting occurs in a first processing unit and wherein said steps of associating and selecting occur in a second processing unit.

10. A method according to claim 7 and also including the steps of receiving user feedback in response to said at least one selected
20   and implanted image and providing said user feedback to said video server.

11. A method for personalizing video sequences, the method comprising
the steps of:

storing a multiplicity of video sequences stored in a video server;

broadcasting a video sequence to a plurality of clients, wherein

5   each video sequence is accompanied by video parameters for
placement of insertable images;

per client:

storing a plurality of user-matched, locally stored images; and

inserting at least one of said locally stored images into a video

10   sequence transmitted by said broadcaster.

12. A method according to claim 11 and also comprising the steps of
generating user profiles and providing images to each local image
storage unit based on the user profile of the user associated with
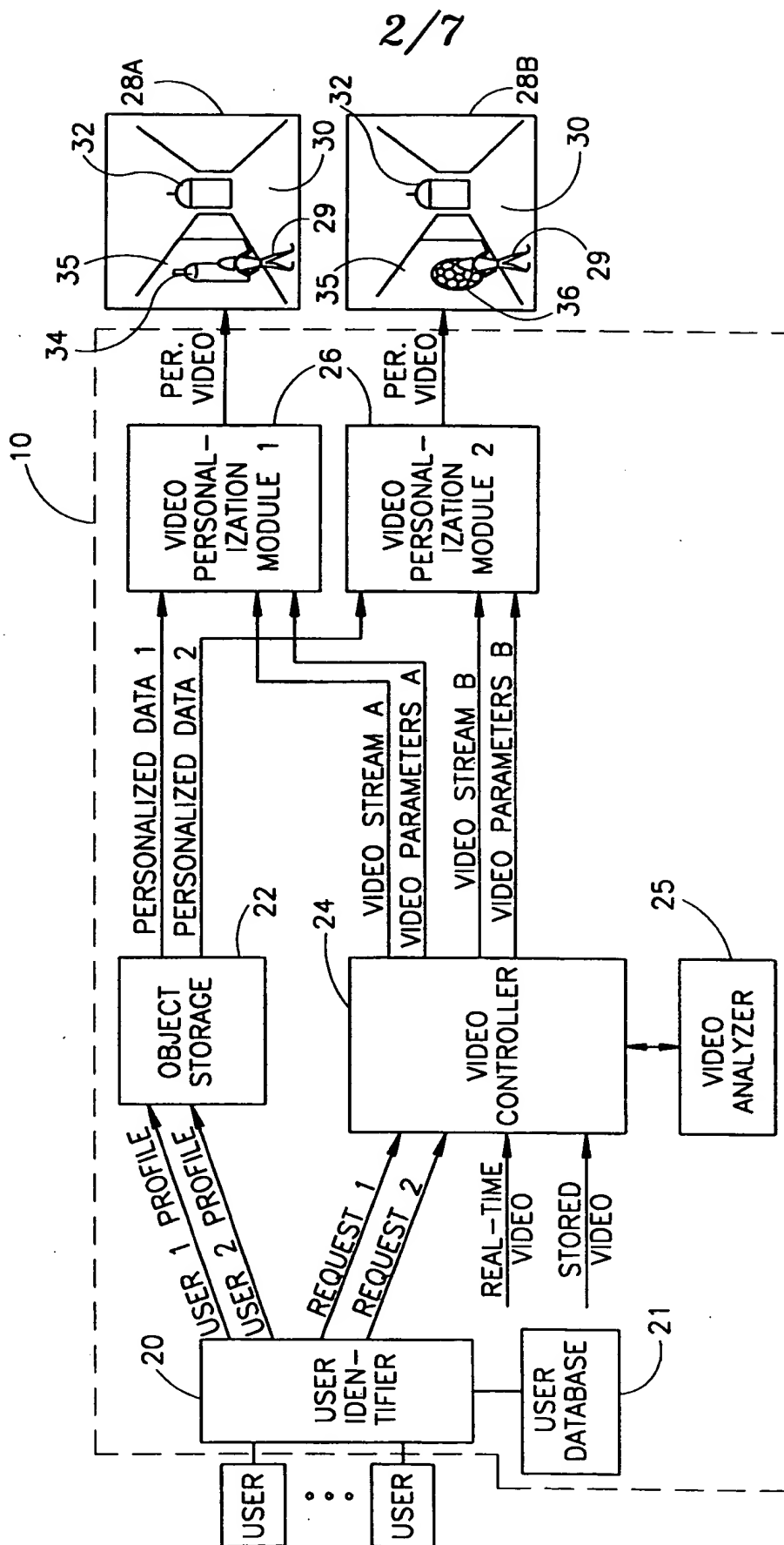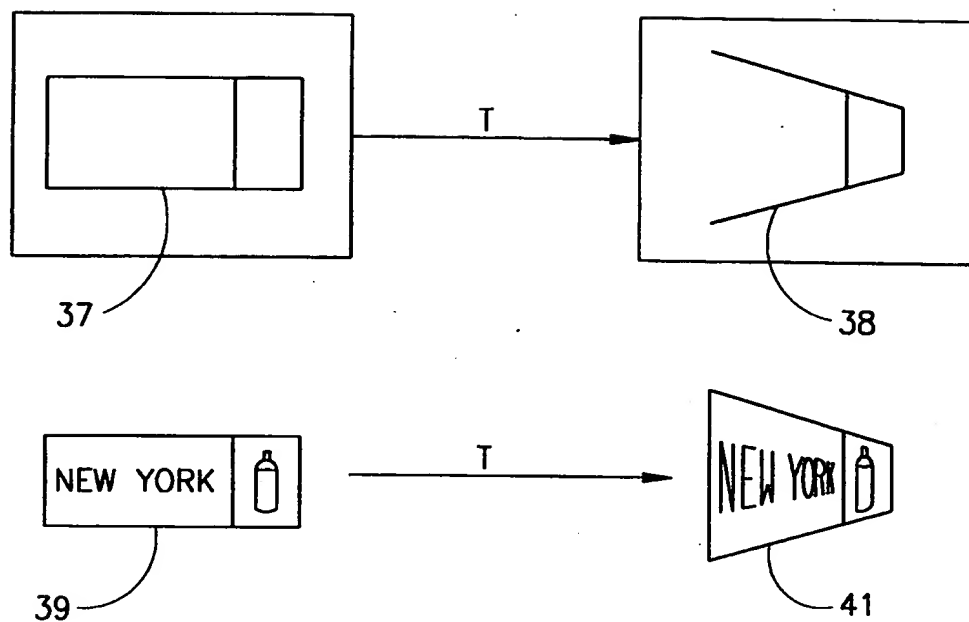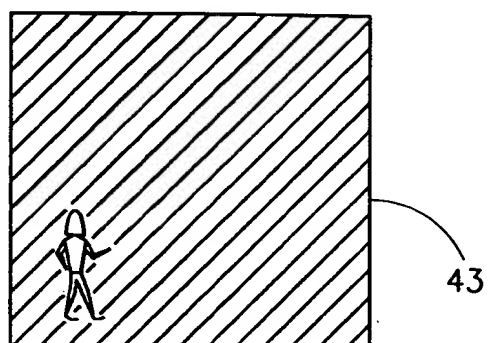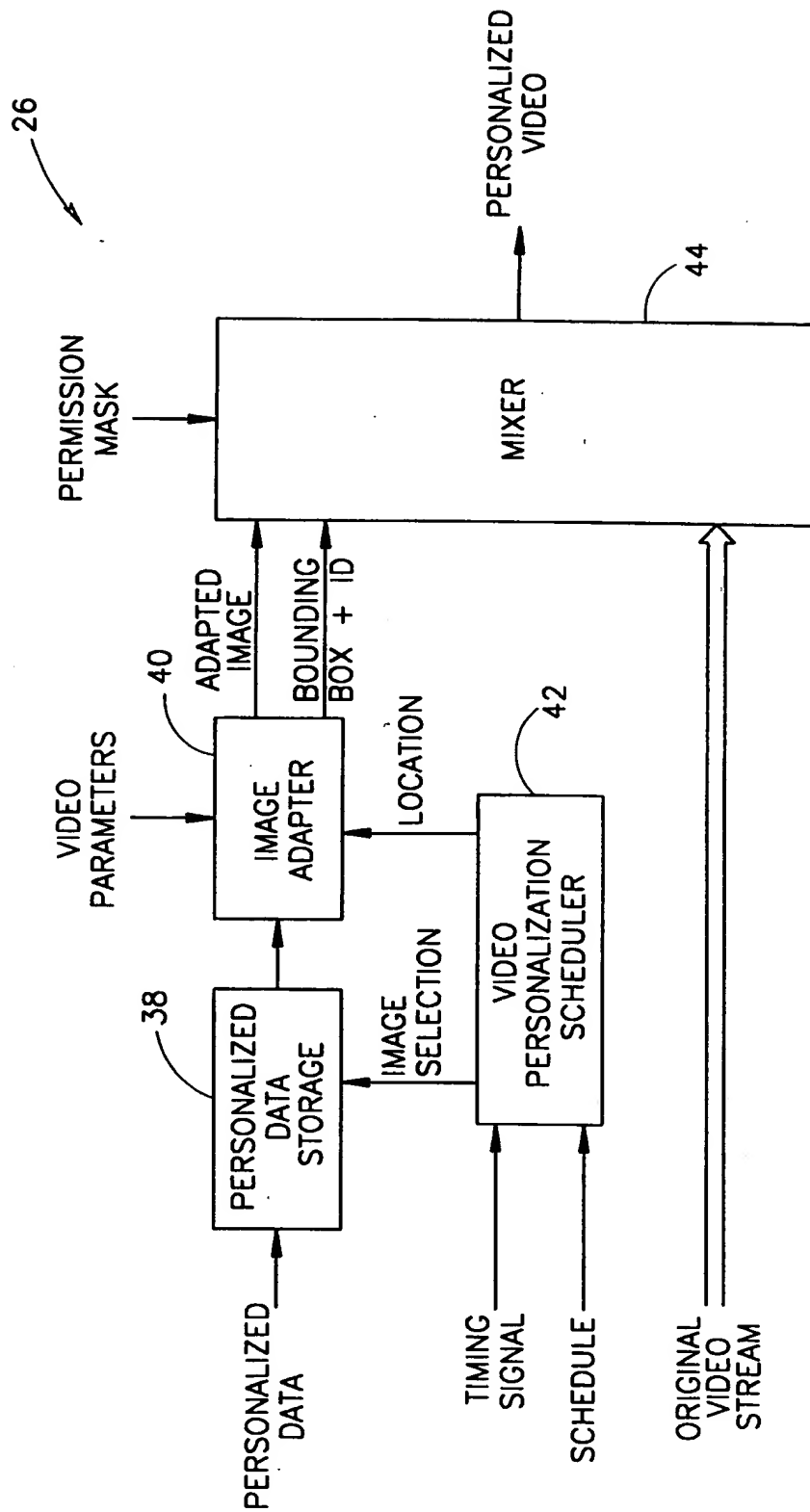each client.

15

20

1/7

FIG.1

2/7
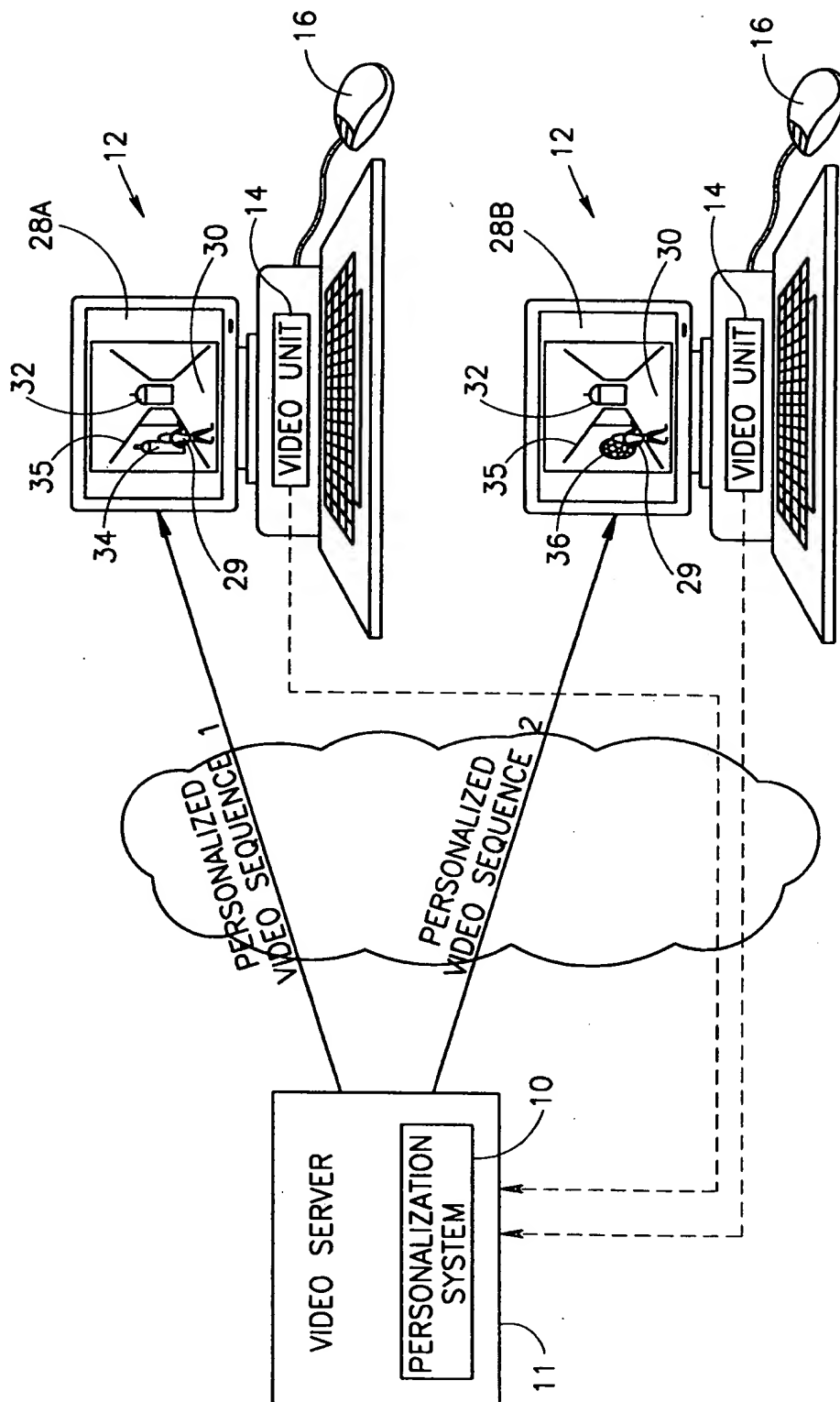
FIG.2

FIG.3A

FIG.3B

4/7

FIG.4
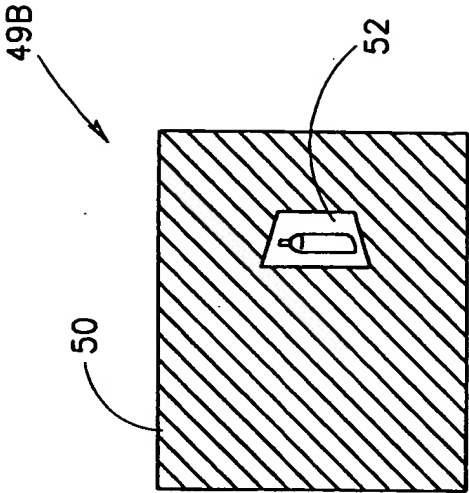
FIG.5B
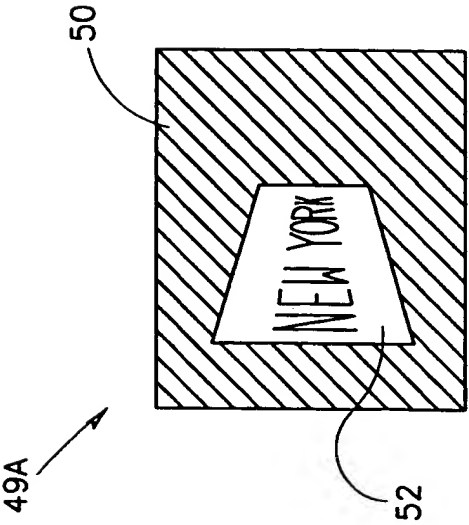
FIG.5A
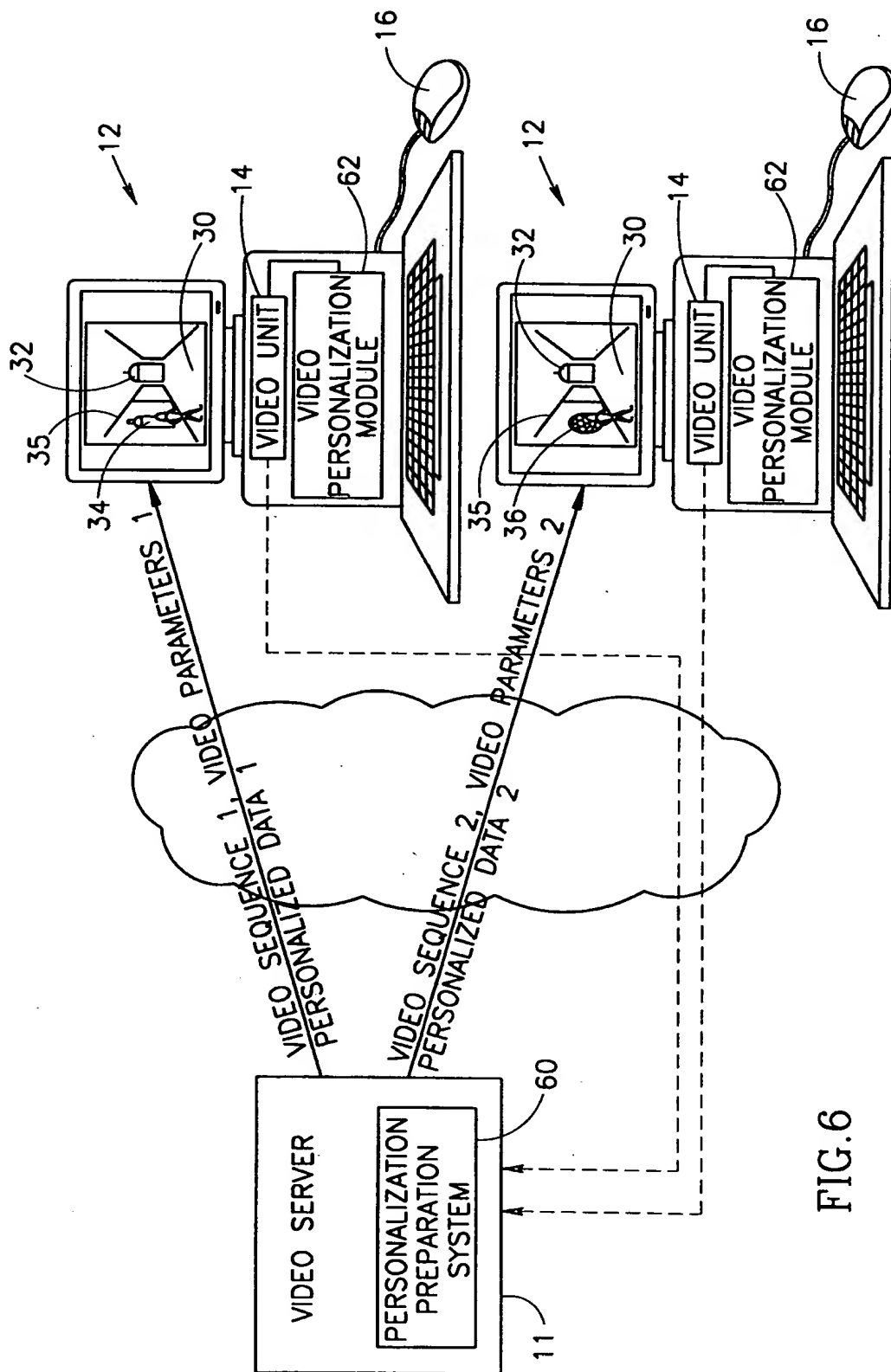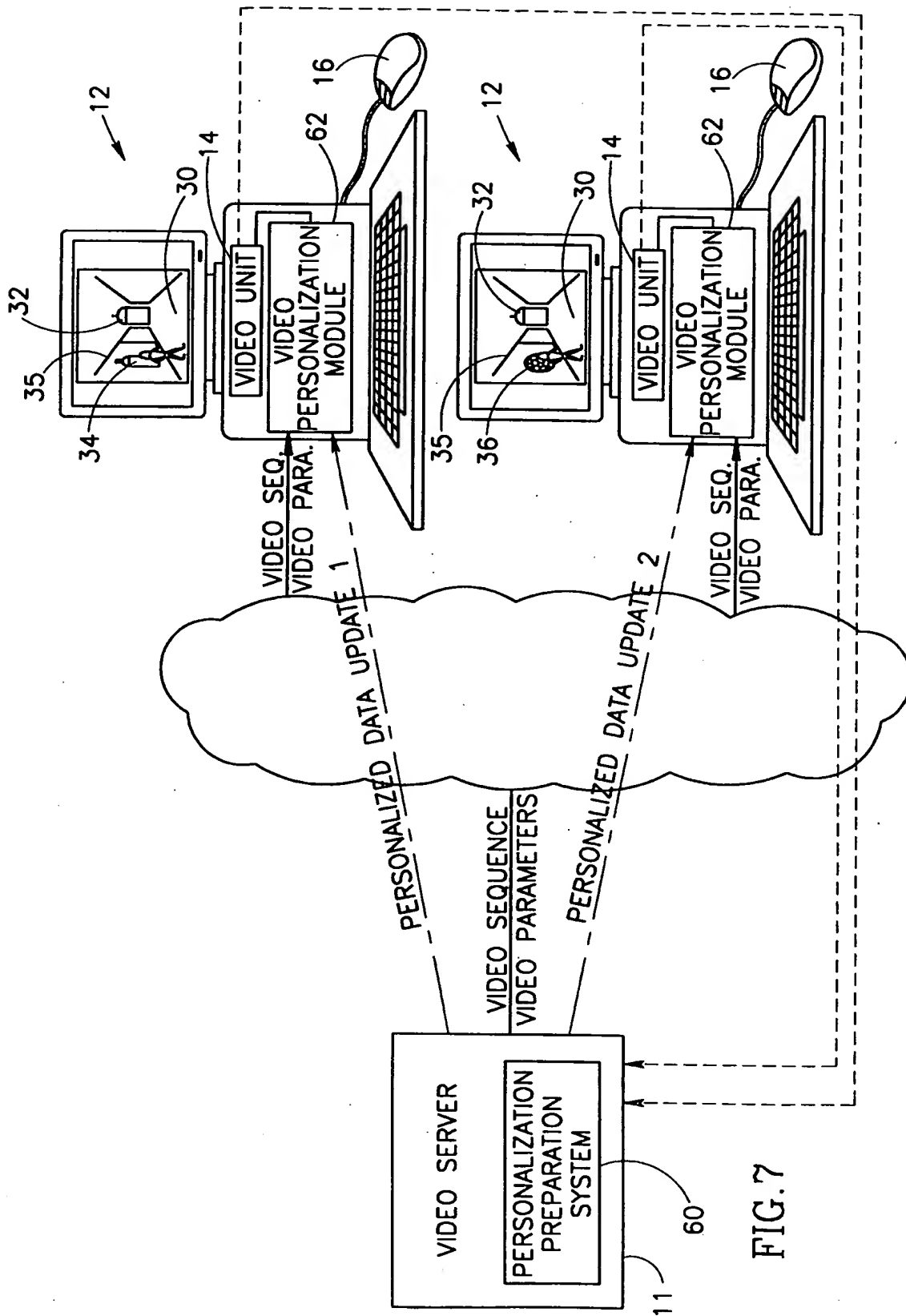
FIG.6

7/7

FIG.7

INTERNATIONAL SEARCH REPORT

A.   CLASSIFICATION OF SUBJECT MATTER

IPC(6)   : H04N 7/10
US CL   :705/27; 348/7

According to International Patent Classification (IPC) or to both national classification and IPC

B.   FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. :   705/14,26,27; 348/7,13; 386/35, 40, 83, 124

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

C.   DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US 5,761,601 A (NEMIROFSKY et al.) 02 June 1998, abstract	1-12
Y	US 5,029,014 A (LINDSTROM) 02 July 1991, Abstract	1-12
Y,P	US 5,715,018 A (FASCIANO et al.) 03 February 1998, abstract	1-12
Y	US 4,991,011 A (JOHNSON et al.) 05 February 1991, abstract	1-12
Y	US 5,600,366 A (SCHULMAN) 04 February 1997, abstract.	1-12
Y	US 5,283,639 A (ESCH et al.) 01 February 1994, abstract.	1-12

☐   Further documents are listed in the continuation of Box C.   ☐   See patent family annex.

*   Special categories of cited documents:

"A"   document defining the general state of the art which is not considered to be of particular relevance

"E"   earlier document published on or after the international filing date

"L"   document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O"   document referring to an oral disclosure, use, exhibition or other means

"P"   document published prior to the international filing date but later than the priority date claimed

"T"   later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"   document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"   document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"   document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 FEBRUARY 1999	25 MAR 1999

| Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No.   (703) 305-3230 | Authorized officer

DUNG DINH   *James A. Matthews*

Telephone No.   (703) 305-9600 |

Form PCT/ISA/210 (second sheet)(July 1992)*